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The Naval Oceanographic and Atmospheric Laboratory (NOARL) is developing techniques to map water depths in clear, shallow waters from multispectral imagery. The Airborne Multispectral System (AMS) consists of a suite of sensors including the NOARL Multispectral Scanner (MSS), Hydrographic Airborne Laser Sounder (HALS), Litton 72 Inertial Navigation System (INS), Rockwell Collins Global Positioning System (GPS), and a radar altimeter on board a Navy P-3 aircraft. Using an airborne multispectral scanner as a bathymetry sensor requires an accurate geometric registration of measured depth points to image pixels. The absolute depth is derived from a source external to the multispectral sensor (i.e., laser sounder or ship derived depths). In order to accurately model the correlation between the depth and multispectral reflectance these depths must be mapped precisely to the multispectral imagery. Following the mapping procedure, regression techniques are employed to compute a depth for each pixel. Once depths are computed for the entire image, accurate positioning is required for merging independent flightlines to produce accurate high resolution bathymetric charts.

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SAR

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The Naval Oceanographic and Atmospheric Laboratory (NOARL) is developing techniques to map water depths in clear, shallow waters from multispectral imagery. The Airborne Multispectral System (ABS) consists of a suite of sensors including the NOARL Multispectral Scanner (MSS), Hydrographic Airborne Laser Sounder (HALS), Litton 72 Inertial Navigation System (INS), Rockwell Collins Global Positioning System (GPS), and a radar altimeter on board a Navy P-3 aircraft. Using an airborne multispectral scanner as a bathymetry sensor requires accurate geometric registration of measured depth points to image pixels. The absolute depth is derived from a source external to the multispectral sensor (i.e. laser sounder or ship derived depths). In order to accurately model the correlation between the depth and multispectral reflectance these depths must be mapped precisely to the multispectral imagery. Following the mapping procedure, regression techniques are employed to compute a depth for each pixel. Once depths are computed for the entire image, accurate positioning is required for merging independent flightlines to produce accurate high resolution bathymetric charts.

Roll and pitch are received from the Litton 72 inertial navigation system. These parameters are updated at the rate of 10 per second. With the scan rate at approximately 100 Hz an update in the aircraft's attitude occurs every 10 scanlines. The GPS parameters including latitude, longitude and drift are updated once a second or an update every 100

A standard approach for setting up a data structure would be to store the position of the lower left corner in a file header, set up a rectangular region and compute offsets from the lower left corner and placing each pixel in it's proper cell. Since the flight lines are not oriented true N-S or E-W this method would leave large areas in the file empty. The method developed minimizes the 'dead space' in the file and allows the data to be in both 'line - element' and geographic coordinate space. Each flight line is divided into .6 X .5 km subareas. Each subarea is then rectified independently, each having it's own set of mapping coefficients allowing each pixel to be geographically referenced. The aircraft is typically flown at an altitude of 500 m. Given a .002 radian instantaneous field of view the pixel size at nadir is 1 m, increasing in size to 1.7 m at the furthest off nadir pixel. The grid resolution chosen is 1 m.

The algorithms were implemented on a VAX 8800 with a processor speed of 12 mips. For a .6 X .5 km area the processing time was 1 min, 10 sec.

The complete set of navigation and attitude data allow rectification without picking control points, minimizing user intervention.

Codes

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